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**THE DETERMINATION OF TWIN ZYGOSITY
BY QUESTIONNAIRE METHOD**

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ODREĐIVANJE ZIGOTNOSTI BLIZANACA METODOM UPITNIKA

U radu je verificirana metoda upitnika za određivanje zigotnosti blizanaca školske dobi, u cilju istraživanja genetičke uvjetovanosti motoričkih sposobnosti i predispozicije za različite sportske aktivnosti. Kao osnova konstrukcije izabrane su varijante upitnika Sarna-e i suradnika, 1978 i Torgersena, 1979, te njihovi načini evaluacije i klasifikacije blizanaca. Ispitan je uzorak od oko 200 pari istospolnih blizanaca u dobi od 7 do 16 godina. U periodu od 1982. do 1985. verificirani su različiti tipovi pitanja i oblici upitnika i izabrane različite varijante evaluacije individualnih (pojedinačnih) pitanja u upitniku. Obzirom na dob ispitanih blizanaca upitnik je snabdjeven i dodatnim pitanjima za roditelje.

Na temelju rezultata istraživanja konstruirana je autorova modifikacija upitnika za određivanje zigotnosti blizanaca. Upitnik ima dva dijela – A, koji popunjava svaki blizanac para nezavisno od drugoga, i B – koji sadrži pitanja za roditelje. Evaluaciju oba dijela upitnika obavlja iskusni istraživač tako da razmatra pojedinačne odgovore i prema njima klasificira svaki par blizanaca kao mono ili dizigotni. U slučaju da se pojavi kontradikcija unutar odgovora na neka pitanja ili u konačnoj odluci o klasifikaciji nekog para blizanaca, taj se par izostavlja iz daljnjeg istraživanja. Time se povećava vjerojatnost točnog određivanja zigotnosti.

Predloženi upitnik omogućuje primjenu metode proučavanja blizanaca na velikim uzorcima školske djece, bez potrebe uključivanja kompliciranih laboratorijskih testova i metoda.

The occurrence of twins in human population is one of the most interesting as well as favourable circumstances which to a considerable extent contribute to acquiring valuable information concerning the reciprocal influence of heredity and environment. This fact has been pointed out by GALTON and with the works of HOLZINGER (1929) twin studies became undoubtedly one of the most frequently applied and from the point of view of methodology the most convincing methods of genetic analysis of quantitative traits.

For the twin method, knowledge of zygosity is indispensable, i.e. that is the determination whether an individual is from the monozygotic (uniovular, identical) or dizygotic (dioivular, fraternal) pair of twins. In case the sex of the twins is the same, further investigation is always necessary. Generally used method for zygosity determination is the elimination of possibility of monozygosity on the basis of discordance in certain features and only when there is concordance in all the features studied, we can accept the presumption of monozygosity of individuals in the pair.

Of all the methods used for the determination of twin zygosity the most frequently applied are the so called similarity tests, investigating various body traits, the analysis of blood and serum groups, the use of fingerprints and palmprints and, recently, also the method of tissue microtransplantation. We should also mention the questionnaire method. We discuss this method in detail in this paper especially with regard to our own modification of the questionnaire which we carried out for the determination of twin zygosity of school age children.

The questionnaire method has been developed mainly to classify large numbers of individuals in common population, just as applied, for example, in various epidemiological studies. As far as we know this method was first used by ZAZZO (1960). Then CADERFLOF et al. (1961) investigated six hundred pairs of like-sexed twins. At the same time he also attempted verification of the validity of this method. He selected a sample of 200 pairs for further investigation in which 5 independent systems were used to determine the blood groups of each twin. By comparison of both methods he drew a conclusion that the questionnaire method and the blood analysis were concordant in about 95%. In 1966 the WHO congress discussed the validity and the use of this method again and the method itself was recommended for determination of zygosity in epidemiological studies.

The following years the questionnaire method was used by other authors (NICHOLS, BILBRO 1966; HAUGE et al. 1968; COHEN et al. 1973; WEISS 1980). Each of them modified, more or less, the contents of his own questionnaire. One of the most extensive studies which greatly contributed to further improving and particularly to repeated verification of the validity of the questionnaire method is the study carried out by SARNA et al. (1978) in Finland and TORGENSEN (1979) in Norway. Both of them confirmed a relatively high degree of validity of the questionnaire by comparison of the questionnaire method and the blood tests. According to the way of evaluation of items (questions) and different age groups of the twins investigated, the degree of concordance was about 95% and even higher. This means that the questionnaire

method itself has a considerable validity and can be recommended for a number of studies of twins where there is not a great demand on high probability for correct zygosity determination. For improving the reliability and the validity of the diagnosis of the questionnaire method, it is suitable to combine it with some other methods, for example the analysis of blood and serum groups. But it is known that even then we can not expect 100% probability.

The aim of our work was to verify the questionnaire method for the study of twins of school-age in connection with the question of genetic conditionedness of various motor abilities and the predisposition for sports activity. As a starting point we have chosen the variants of the questionnaire by SARNA et al. and TORGERSEN, and also their ways of evaluation and classification of the twins. We investigated a sample of about 200 pairs of like-sexed twins of the age from 7 to 16. During the years 1982-85 we verified various types of questions and forms of questionnaire and chose different variants of evaluation of the individual items of the questionnaire. With respect to the age of the twins investigated we supplemented the questionnaire with other items determined for parents. All the investigation was made possible by the responsible researcher, the director and the teacher of the school, pupils and parents.

The result of our study is our own modification of the questionnaire method for twin zygosity determination (see the appendix). The questionnaire has two parts — A, which is determined for each individual of the pair (each twin completed the questionnaire without consulting the other) and — B, which contains the answers of the twins parents. The evaluation of both parts of the questionnaire is carried out by an experienced person who on the ground of separate answers classifies each pair as either monozygotic or dizygotic twins. In case of contradiction between the answers to some items (or the final decision about classification of the pair) the pair is excluded from further investigation, thus extending the degree of probability of correct zygosity determination.

The proposed questionnaire provides the method of the twin study at large samples of the school children population without complicated laboratory investigation. Various motor tests can be the aim of further study of the influence of heredity and environment on the variability of human motor manifestation and motor and sports performance.

QUESTIONNAIRE FOR DETERMINATION OF THE TYPE OF TWINS

— A —

This part is intended for **like-sexed twins**. Each twin completes the questionnaire alone without previous consulting the other twin.

Mark the correct answer!

- I. Write your name, surname, date of birth, address
Name and surname:
Date of birth:
Address:
- II. Write your twin's name:
- III. Which of you was born first?
a) myself
b) brother — sister
- IV. Do you live in one family?
a) yes
b) no
- V. Have you and your twin partner had, since your childhood, the feeling you can not live without each other (inseparable couple) or you feel like common siblings?
a) inseparable couple
b) like common sibs
c) I do not know
- VI. Are you so a like that people mix you up?
a) yes — very often
b) now and then
c) never
- VII. Who mix you up?
a) parents
b) teachers
c) others
d) nobody

QUESTIONNAIRE FOR DETERMINATION OF THE TYPE OF TWINS

— B —

This part is intended for **parents** of like-sexed twins. It follows the questions answered by children. Mark the correct answer!

- I. Consider the relationship between your twins tested in question No.V. The children lived as:
a) inseparable couple
b) common sibs
c) I do not remember
- II. Are your children twins or of multiple childbirth?
a) twins
b) triplets
c) multiple (fill up)
- III. Were you told during the childbirth that you were having uniovular or dioovular (monochorial, bichorial) twins?
a) no
b) uniovular
c) dioovular
- IV. Have your twins the same eye colour?
a) yes
b) no
- V. Have your twins the same hair colour?
a) yes
b) no
- VI. Have your twins the same body appearance?
a) absolutely the same
b) almost the same
c) likeness as other sibs
d) they are completely different

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ОПРЕДЕЛЕНИЕ ЗИГОТНОСТИ БЛИЗНЕЦОВ ПРИ ПОМОЩИ МЕТОДА ВОПРОСНИКА

В настоящей работе проверяется метод вопросника для определения зиготности близнецов школьного возраста, с целью исследования генетической обусловленности двигательных способностей и склонности к различным видам спорта. В основу вопросника вошли переменные вопросников Сары и сотрудников (1978) и Тоггерсена (1979), а также принципы оценки и классификации близнецов, на которых они построены. Проведено исследование 200 пар однополых близнецов в возрасте от 6 до 16 лет. В период 1982–1985 гг. проверялись различные виды вопросников и их формы и выбирались различные оценки отдельных вопросов. В зависимости от возраста испытуемых в вопроснике имелись и дополнительные вопросы для родителей.

На основе результатов исследования автор работы составил собственный вариант вопросника для определения зиготности близнецов. Вопросник состоит из двух частей: части А, на которую отвечает каждый близнец отдельно и части Б, содержащей вопросы для родителей. Оценку ответов проводит опытный исследователь, рассматривая каждый ответ и на основании этого классифицирует каждую пару, како моно — или дизиготную. В случае появления противоречия в ответах на некоторые вопросы или в окончательном решении о классификации определенной пары, такая пара выключается из дальнейшего исследования. Таким образом, повышается вероятность точного определения зиготности.

Предлагаемый вопросник позволяет проведение исследования близнецов на больших выборках детей школьного возраста, при чем исключается необходимость использования сложных лабораторных тестов и методов.

